A FEW NOTES ON THE CHEMICAL COMPOSITION OF BEE BREAD

By Ruth L. Phillips

During the past year I have been studying the growth changes in the nerve cells of the honey bee, *Apis mellifica*. Since nutrition plays a very important part in such changes throughout the life history of the insect I was interested to ascertain the chemical composition of the nitrogenous food of bees. This is popularly called bee bread, and consists mainly of the different kinds of pollen collected by the insects on their foraging expeditions which is mixed with a small amount of honey and wax. Such pollen is probably representative, in its chemical content, of pollen in general. Therefore I am giving the results of the chemical analysis in case they might prove interesting to botanists.

The time at my disposal was not long, so it was impossible to make more than one analysis, but still this represents, in the main, several analyses, as each determination represents the average of a series, several samples being taken and the final results computed as the averages of these. Therefore, with the exception of the wax to which I will refer later, the following figures represent approximately the composition of such pollen as is stored by the average hive of bees in mid summer. The sugar content is undoubtedly high for pure pollen since a certain amount of honey is used in making the bread.

Bee bread and bee's wax both oxidize at a low temperature. For this reason the water was determined by drying in vacuo over concentrated sulphuric acid, necessarily a rather slow process. Had the presence of wax been suspected I should have determined it in the same way. However when its presence was discovered there was only time for a hasty determination by drying in a water oven, so the figures for the wax are much too high. As this is in no way a food, acting probably as a preservative, it does not affect the analysis of the pollen as such. Dr. Phillips, Bee Expert for the Department of Agriculture, suggests that this wax may have come from carelessness in removing the pollen from the

cells. However, this very thing was carefully avoided, and although it is somewhat difficult to get the pollen without getting wax at the same time, I am certain that there could not have been enough obtained in that way to give the percentage resulting, even when corrected for the oxidation which occurred.

As one would naturally expect, there was a large amount of water in this substance, 12.75 per cent. being obtained. The bulk of the remainder is protein, 64.4 per cent., not too high when we remember that pollen is mainly protoplasm. 9.23 per cent. of fat were found. A peculiarity of this fat is worth noting. It appeared to be made up of several oils, some of which were extremely volatile and had a very penetrating disagreeable odor. Both cane sugar and sucrose were present, the total sugar content being 9.5 per cent. of which 1.3 per cent. was cane sugar, and 8.2 per cent. sucrose. The wax would probably give between three and five per cent if a more accurate determination were made.

	Per Cent.	
Water	12.75	(Would vary with conditions.)
Protein	64.4	(Probably constant to a fraction of a per cent.)
Fat	9.23	(Probably constant to a fraction of a per cent.)
Sugar	9.00	(Would vary with the amount and kind of honey.)
Wax	3 to 5	(Probably fairly constant.)

It would be interesting to analyze several pollens and compare them with the above composite pollens. In fact for a standardization of pollen such a scheme would be necessary. Yet since the amounts of the different substances that go to make up protoplasm do not vary greatly it is a question whether a series of analyses of the different pollens would differ to any great extent from the above analysis of the mixed pollen.

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TRAGOPOGON IN COLORADO

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Some years ago (1905) I noted that two species of *Tragopogon* were growing in Boulder, Colorado. Upon examination, they appeared to accord excellently with the two species credited to